

COMBINED TRANSMITTAL OF APPEAL BRIEF TO THE BOARD OF PATENT
APPEALS AND INTERFERENCES & PETITION FOR EXTENSION OF TIME
UNDER 37 C.F.R. 1.136(a) (Large Entity)

Docket No.
SEC.1051

In Re Application Of: Myung-Ah KANG et al.

SEP 18 2006

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/608,639	30 June 2003	John S. RUGGLES	20987	1756	8355

Invention: PHASE EDGE PHASE SHIFT MASK AND METHOD FOR FABRICATING THE SAME

COMMISSIONER FOR PATENTS:

This is a combined Transmittal of Appeal Brief to the Board of Patent Appeals and Interferences and petition under the provisions of 37 CFR 1.136(a) to extend the period for filing an Appeal Brief.

Applicant(s) hereby request(s) an extension of time of (check desired time period):

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from: 18 June 2006

Date

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In Re Application Of:

Myung-Ah KANG et al.

SEP 18 2006

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10/608,639

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30 June 2003

Examiner

CHRISTOPHER S. RUGGLES

Customer No.

20987

Group Art Unit

1756

Confirmation No.

8355

Invention: PHASE EDGE PHASE SHIFT MASK AND METHOD FOR FABRICATING THE SAME

TO THE COMMISSIONER FOR PATENTS:

This combined Transmittal of Appeal Brief to the Board of Patent Appeals and Interferences and petition for extension of time under 37 CFR 1.136(a) is respectfully submitted by the undersigned:



Signature

Dated: 18 September 2006

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Serial No. 10/608,639
SEC.1051
Appeal Brief dated 18 September 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent application of :
Myung-Ah KANG et al. : Group Art Unit 1756
Serial No. 10/608,639 : Examiner John S. RUGGLES
Filed 30 June 2003 :
PHASE EDGE PHASE SHIFT MASK AND
METHOD FOR FABRICATING THE SAME

APPEAL BRIEF

U.S. Patent and Trademark Office
Customer Window, Mail Stop Appeal Brief – Patents
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Sir:

In response to the FINAL Office Action dated 18 November 2005, and in support of the Notice of Appeal filed on 18 April 2006, Applicants hereby submit this Appeal Brief.

REAL PARTIES IN INTEREST

Samsung Electronics Co. Ltd. owns all of the rights in the above-identified U.S. patent application by virtual of an assignment recorded at Reel 014255, Frame 0059.

RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences related to this application or to any related application, nor will the disposition of this case affect, or be affected by, any other application directly or indirectly.

09/20/2006 MAHME1 00000065 500238 10608639
01-FC-1402 1000-00-DA
02-FC-1253 1020-00-DA

STATUS OF CLAIMS

Claims 2-12 and 14-20 all stand rejected, and claims 1 and 13 are cancelled. Accordingly, the claims on appeal are claims 2-12 and 14-20.

STATUS OF AMENDMENTS

There are no pending amendments with respect to this application.

SUMMARY OF CLAIMED SUBJECT MATTER

The present invention is directed to a phase edge phase shift mask, and a method for fabricating a phase edge phase shift mask.

Accordingly, as broadly recited in claim 7, a method of fabricating a phase edge phase shift mask (100 FIGs. 3A and 5A-C) comprises: providing a transparent substrate (105 – FIGs. 3A and 5A-C; paragraph [0100], line 1); etching the transparent substrate (paragraph [0110], lines 3-4) to form a trench (110 – FIGs. 3A and 5A-C) in the substrate, the trench being situated beneath a first surface of the substrate and having a side defined by a sidewall surface of the substrate and a second surface of the substrate defining a bottom surface of the trench (FIG. 5A); forming a layer of material (115 – FIG. 5B) on the substrate at the side thereof in which the trench is formed (paragraph [0115], lines 1-4); and etching the layer of material (paragraph [0120], lines 1-3) to form an auxiliary pattern (120 – FIG. 5C) therefrom on at least one of said first and second surfaces of said substrate as spaced laterally along said at least one of the first and second surfaces from said sidewall surface defining the side of the trench (paragraph [0090], lines 7-9; FIG. 5C), wherein when the mask is used to pattern a photoresist layer, a photoresist pattern is formed at an area corresponding to an edge of the trench, and is not formed at areas corresponding to the auxiliary pattern (FIG. 3B; paragraph [0095], lines 1-11; paragraph [100] lines 7-9).

As broadly recited in claim 8, the invention further features the forming of a

layer of material on the substrate comprising forming a layer of an optical interference material on the substrate (paragraph [0090], lines 9-10).

As broadly recited in claim 9, the invention further features the forming of a layer of material on the substrate comprising forming a layer of an opaque material on the substrate (paragraph [0090], lines 9-10; paragraph [0115], lines 1-4).

As broadly recited in claim 10, the invention further features the opaque material being chromium (paragraph [0090], lines 9-10; paragraph [0115], lines 1-4).

As broadly recited in claim 11, the invention further features the etching of a portion of the material comprising forming an auxiliary pattern having a line width of 30 nm to 200 nm on at least one of said first and second surfaces of said substrate as spaced laterally along said at least one of the first and second surfaces from said sidewall surface defining the side of the trench (paragraph [0090], lines 7-14; paragraph [0120], lines 1-9).

As broadly recited in claim 12, the invention further features the transparent substrate being quartz (paragraph [0090], lines 1-2; paragraph [0100], line 1).

As broadly recited in claim 14, a phase edge phase shift mask (100 – FIG. 3A) comprises: a transparent substrate (105 – FIGs. 3A and 5A-C; paragraph [0100], line 1) having a first surface and a trench (110 – FIGs. 3A and 5A-C) constituting a 180° phase shift region (paragraph [0090], lines 2-4), a second surface defining a bottom of the trench, and a sidewall surface extending from the first surface to the second surface and defining a side of the trench (FIG. 5A); and an auxiliary pattern (120 – FIG. 5C) disposed on at least said second surface, wherein when the mask is used to pattern a photoresist layer, a photoresist pattern is formed at an area corresponding to an edge of the trench, and is not formed at areas corresponding to the auxiliary pattern (FIG. 3B; paragraph [0095], lines 1-11; paragraph [100] lines 7-9).

As broadly recited in claim 15, the invention further features the transparent substrate being quartz (paragraph [0090], lines 1-2; paragraph [0100], line 1).

As broadly recited in claim 2, the invention further features the auxiliary pattern being disposed on at least one of a central portion of the first surface and a central portion of the second surface (paragraph [0090], lines 7-9; FIG. 5C).

As broadly recited in claim 3, the invention further features the auxiliary pattern being of an optical interference material (paragraph [0090], lines 9-10).

As broadly recited in claim 4, the invention further features the auxiliary pattern being of an opaque material (paragraph [0090], lines 9-10; paragraph [0115], lines 1-4).

As broadly recited in claim 5, the invention further features the auxiliary pattern being made of chromium (paragraph [0090], lines 9-10; paragraph [0115], lines 1-4).

As broadly recited in claim 6, the invention further features the auxiliary pattern having a line width of 30 nm to 200 nm (paragraph [0090], lines 7-14; paragraph [0120], lines 1-9).

As broadly recited in claim 16, a phase edge phase shift mask (100 – FIG. 3A) comprises: a quartz substrate (105 – FIGs. 3A and 5A-C; paragraph [0100], line 1) having a first surface and a trench (110 – FIGs. 3A and 5A-C) constituting a 180° phase shift region (paragraph [0090], lines 2-4), a second surface defining a bottom of the trench, and a sidewall surface extending from the first surface to the second surface and defining a side of the trench (FIG. 5A); and an auxiliary pattern (120 – FIG. 5C) disposed on said first and second surfaces, wherein when the mask is used to pattern a photoresist layer, a photoresist pattern is formed at an area corresponding to an edge of the trench, and are not formed at areas corresponding to the auxiliary pattern (FIG. 3B; paragraph [0095], lines 1-11; paragraph [100] lines 7-9).

As broadly recited in claim 17, the invention further features the auxiliary pattern being of an optical interference material (paragraph [0090], lines 9-10).

As broadly recited in claim 18, the invention further features the auxiliary pattern being of an opaque material (paragraph [0090], lines 9-10; paragraph [0115], lines 1-4).

As broadly recited in claim 19, the invention further features the auxiliary pattern being of chromium (paragraph [0090], lines 9-10; paragraph [0115], lines 1-4).

As broadly recited in claim 20, the invention further features the auxiliary pattern having a line width of 30 nm to 200 nm (paragraph [0090], lines 7-14;

paragraph [0120], lines 1-9).

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

The issues on Appeal are:

- (1) the rejection of claims 2-12 and 14-20 under 35 U.S.C. § 112, second paragraph;
- (2) the rejection of claims 2-5, 7-10, 12 and 14-15 under 35 U.S.C. § 102 & 103 over Ham U.S. patent 5,567,552 (“Ham”);
- (3) the rejection of claims 6 and 11 under 35 U.S.C. § 103 over Ham in view of Randall et al. U.S. patent application publication 2002/0094492 (“Randall”);
- (4) the rejection of claims 16-19 under 35 U.S.C. § 103 over Ham in view of Kamon U.S. patent 6,737,198 (“Kamon”) or Steinberg et al. U.S. patent application publication 2002/0031711 (“Steinberg”); and
- (5) the rejection of claim 20 under 35 U.S.C. § 103 over Ham in view of Kamon or Steinberg and further in view of Randall.

ARGUMENTS

1) Claims 2-12 and 14-20 All Comply with 35 U.S.C. § 112, 2nd Paragraph

The Office Action dated 18 November 2005 rejected claims 2-12 and 14-20 under 35 U.S.C. § 112, second paragraph, as supposedly being indefinite.

Applicants traverse those rejections and submit that claims 2-12 and 14-20 all fully comply with the requirements of 35 U.S.C. § 112, 2nd Paragraph.

In the first instance, the Examiner argues that the use of plural “areas” in claim 7, at line 16, in claim 14, at line 9, and in claim 16, at line 9 (and the concomitant use of the associated verb “are”), causes all of those claims (and the dependent claims 2-6, 8-13, 15, and 17-20) to be indefinite.

Applicants strongly disagree. There is absolutely nothing vague or indefinite about the word “areas.” Contrary to the Examiner’s completely unfounded and totally

unexplained assertion, there is absolutely nothing in claims 7, 14 or 16 that “*require[s] interpretation*” of the plain claim language to be “singular.” Applicants specifically note that FIG. 5C, for example, shows an embodiment of an auxiliary pattern having three separated individually-contiguous portions. In such a case, as shown extremely clearly for example in FIG. 3B, when the mask is used to pattern a photoresist layer, a photoresist pattern is not formed at areas corresponding to the auxiliary pattern 120.

Accordingly, Applicants respectfully submit that this basis for rejection of claims 2-12 and 14-20 under 35 U.S.C. § 112, second paragraph is factually in error, and must be reversed.

The Examiner also states that is “unclear how” certain language in claims 7, 14, and 16 “further limits the actual method” of claim 7, or how it “further limits the actual structure” of the masks recited in claims 14 and 16.

At the outset, even if, *arguendo*, one assumed that the language in question did not “further limit” the method of claim 7 or the structure of the masks of claims 14 and 16, this is no basis for a rejection under 35 U.S.C. § 112, second paragraph. 35 U.S.C. § 112, second paragraph includes absolutely no requirement that every word or phrase in a claim “further limit the actual method” of a method claim, or “further limit the actual structure” of a device claim. Indeed, the Patent Office regularly states that language in a claim preamble, “whereby” clauses in the body of a claim, and other language (including “intended use” language!) does not further limit claimed subject matter. And yet Applicants are aware of no case or precedent where it has been held that such language that does not “further limit the method” of a method claim, or “further limit the structure” of a device claim, renders the claim invalid under 35 U.S.C. § 112, second paragraph. Thus it is not surprising that the Examiner fails to cite even a single case or other authority for this new and interesting proposition!

The only requirement under is that the claims must “particularly point out and distinctly claim the subject matter which the applicant regards as his invention.”

Applicants respectfully submit that all of the claims 2-12 and 14-20 easily meet this requirement.

Furthermore, Applicants respectfully submit that the language in question does indeed “further limit the actual method” of claim 7, and “further limits the actual structure” of the masks recited in claims 14 and 16.

At the outset, claims 14 and 16 do not recite “an intended use” of the claimed mask, but instead recite specific characteristics of the claimed mask. For example, claims 14 and 16 do not recite “wherein the mask is used to pattern a photoresist layer.” Instead, claims 14 and 16 each recite a specific characteristic of the mask under certain conditions (indeed one of the characteristics that distinguish it from Ham’s mask). Namely, “when the claimed mask is used to pattern a photoresist layer” it has the characteristic that “a photoresist pattern is formed at an area corresponding to an edge of the trench, and is not formed at areas corresponding to the auxiliary pattern.” Such claim language is extremely common and well accepted in American patent law and is entitled to be accorded full patentable weight.

In similarity, in claim 7, the recited method produces a mask having the property that “when the mask is used to pattern a photoresist layer, a photoresist pattern is formed at an area corresponding to an edge of the trench, and is not formed at areas corresponding to the auxiliary pattern.” Again, this is a specific, concrete property of the mask produced by the claimed method (and one of the properties that distinguishes it from a mask produced by Ham’s method).

Finally, the Examiner states that the phrase “said etching a portion of the material comprises forming an auxiliary pattern” renders claim 11 unpatentable under 35 U.S.C. §112, second paragraph. Applicants respectfully disagree. Particularly in view of the dependence of claim 11 from claim 7, and the recitation of “said etching” harkening back to claim 7, Applicants respectfully submit that anyone of ordinary skill in the art would clearly understand that this phrase pertains to the same layer and same auxiliary pattern as recited in the parent claim 7. This is the true test under 35 U.S.C. §112, second paragraph, and Applicants respectfully submit that claim 12

meets this test.¹

Accordingly, for at least these reasons, Applicants respectfully request that the rejections of claims 2-12 and 14-20 under 35 U.S.C. §112, second paragraph be withdrawn.

2) Claims 2-5, 7-10, 12 and 14-15 are All Patentable over Ham

The Office Action dated 18 November 2005 rejected claims 2-5, 7-10 and 14-15 under 35 U.S.C. § 102 & 103 over Ham.

Applicants respectfully traverse those rejections and submit that claims 2-5, 7-10 and 14-15 are all patentable over Ham for at least the following reasons.

Independent claims 7 and 14 include a combination of features wherein, when the mask is used to pattern a photoresist layer, photoresist patterns are formed at areas corresponding to edges of the trench, and are **not** formed at areas corresponding to the auxiliary pattern. Such a combination of features is described throughout the specification, for example in paragraphs [0075], [0090], [0095], and [0100], and shown in FIGs. 3A-B.

Applicants respectfully submit that Ham does not include such features.

The Office Action states that such a combination of features is somehow “inherent” in Ham.

Applicants respectfully disagree. Not only are such features not “inherent” in Ham, they are absolutely missing from Ham.

Applicants respectfully disagree and traverse the statement of inherency as being directly contrary to the provisions of M.P.E.P. § 2212(IV).

M.P.E.P. § 2212(IV) provides that:

**EXAMINER MUST PROVIDE RATIONALE OR EVIDENCE
TENDING TO SHOW INHERENCY**

¹ Although Applicants remain convinced that the use of the word “portion” instead of “layer” does not rise to the level of a rejection of 35 USC § 112, second paragraph, Applicants would not object to an amendment as suggested by the Examiner in order to advance this case to allowance, if this becomes the only outstanding issue for this application.

The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. In re Rijckaert, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) (reversed rejection because inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art); In re Oelrich, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981). **"To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present** in the thing described in the reference, and that it would be so recognized by persons of ordinary skill in the art. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.' " In re Robertson, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) (citations omitted).

(emphasis added). See also M.P.E.P. § 2144.03 citing In re Lee 277 F.3d 1338 (Fed. Cir. 2002). *"Conclusory statements such as those here provided do not fulfill the agency's obligation."* In re Lee at 1344.

Furthermore, Applicants respectfully submit that such a feature could not possibly be inherent in FIG. 2 of Ham clearly shows that the recited combination of features is not present at all! The Board is respectfully invited to compare FIGs. 3A-B of the present application, showing an embodiment of the present invention, against FIG. 2 of Ham which clearly shows that when the mask is used to pattern a photoresist layer, photoresist patterns are **DEFINITELY** formed at areas corresponding to edges of the trench, and are **ALSO** formed at areas corresponding to the auxiliary pattern 3 (see the bottom of FIG. 2 and also col. 2, lines 51-54).

So, very clearly, Ham does not disclose explicitly or inherently the method of claim 7, or the mask of claim 14. Therefore, no rejection of claims 7, 14 or 16 under 35 U.S.C. § 102 can be maintained.

Regarding any possible rejection under 35 U.S.C. § 103, the Examiner totally failed to explain what motivation existed at the time the invention was made that would have caused anyone of skill in the art at the time the invention was made to modify Ham to include the recited combination of features wherein when the mask is used to pattern a photoresist layer, photoresist patterns are formed at areas corresponding to edges of the trench, and are not formed at areas corresponding to the auxiliary pattern.

M.P.E.P. § 2143.03 provides that:

“Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art.”

Furthermore, M.P.E.P. § 2144.03 provides that:

“there must be some form of evidence in the record to support an assertion of common knowledge. See In re Lee, 277 F.3d at 1344-45, 61 USPQ2d at 1434-35 (Fed. Cir. 2002); Zerko, 258 F.3d at 1386, 59 USPQ2d at 1697 (holding that general conclusions concerning what is “basic knowledge” or “common sense” to one of ordinary skill in the art without specific factual findings and some concrete evidence in the record to support these findings will not support an obviousness rejection).”

(Emphasis added). See also In re Lee, 277 F.3d at 1343-44, 61 USPQ2d at 1433-34 (Fed. Cir. 2002) (**the examiner's finding of whether there is a teaching, motivation or suggestion to combine the teachings of the applied references must not be resolved based on "subjective belief and unknown authority," but must be "based**

on objective evidence of record.”).

No such objective evidence has been provided by the Examiner here, nor did the Examiner submit an affidavit as required by 37 C.F.R. § 1.104(d)(2) if the Examiner’s proposed motivation was based on facts within his personal knowledge (see M.P.E.P. § 2144.03).

Therefore, no rejection of claims 7 or 14 under 35 U.S.C. § 103 can be maintained.

Meanwhile, claims 2-6, 8-13, and 15 all depend variously from claims 7 and 14.

Accordingly, for at least the reasons above, the Applicants respectfully submit that claims 2-5, 7-10 and 14-15 are all patentable over the cited prior art.

3) Claims 6 and 11 are Patentable over Ham and Randall

The Office Action dated 18 November 2005 rejected claims 6 and 11 under 35 U.S.C. § 103 over Ham in view of Randall.

Applicants respectfully traverse those rejections and submit that claims 6 and 11 are patentable over any proper combination of Ham and Randall for at least the following reasons.

Claims 6 and 11 depend from claims 14 and 7, respectively. Randall does not remedy the shortcomings of Ham as explained above with respect to claim 7 and 14. Therefore, claims 6 and 11 and are deemed patentable for at least the reasons set forth above with respect to claims 7 and 14, and for the following additional reasons.

The cited portions of Randall pertaining to the Cr regions 34 and 36 (FIGs. 3a-b), and the 1X mask mentioned in Randall all very refer to **binary** type masks, not phase shift masks as recited in claims 6 and 11, and as described in Ham which the Examiner attempts to modify by resorting to Randall. Of course small patterns are used in such masks. However that provides no suggestion to the inclusion of such features in a phase shift mask, which the Examiner should be aware operates on quite different principles. Meanwhile, the Examiner cites the gate line widths of 150 nm in a fabricated device discussed in Randall as supposedly providing some evidence of the width of an auxiliary pattern on a phase shift mask. Indeed, Randall does not even

apparently discuss any auxiliary pattern in a phase shift mask.

So, no reason has been offered as to why anyone of ordinary skill in the art at the time the invention was made would modify Ham's phase shift mask to make the width of his chrome region 5B to be equal to the patterns used on Randall's binary mask!

Accordingly, for at least all of these reasons, Applicants respectfully submit that claims 6 and 11 are patentable over the cited prior art.

4) Claims 16-19 are all Patentable over Ham in view of Kamon or Steinberg

The Office Action dated 18 November 2005 rejected claims 16-19 over Ham in view of Kamon or Steinberg.

As explained above with respect to claims 7 and 14, Ham does not disclose or suggest a mask that includes a combination of features wherein when the claimed mask is used to pattern a photoresist layer, a photoresist pattern is formed at an area corresponding to an edge of the trench, and is not formed at areas corresponding to the auxiliary pattern." Neither Kamon nor Steinberg remedies these shortcomings.

Accordingly, for at least these reasons, Applicants respectfully submit that claims 16-19 are all patentable over the cited art.

5) Claim 20 is Patentable over Ham in view of Kamon or Steinberg and Randall

The Office Action dated 18 November 2005 rejected claim 20 over Ham in view of Kamon or Steinberg and further in view of Randall.

As explained above with respect to claims 7 and 14, Ham does not disclose or suggest a mask that includes a combination of features wherein when the claimed mask is used to pattern a photoresist layer, a photoresist pattern is formed at an area corresponding to an edge of the trench, and is not formed at areas corresponding to the auxiliary pattern." Neither Kamon nor Steinberg nor Randall remedies these shortcomings.

Furthermore, as explained above with respect to claims 6 and 11, there is no reason why anyone of ordinary skill in the art at the time the invention was made would modify Ham's phase shift mask to make the width of his chrome region 5B to be equal to the patterns used on Randall's binary mask!

Accordingly, for at least these reasons, Applicants respectfully submit that claim 20 is patentable over the cited art.

CONCLUSION

For all of the foregoing reasons, Applicants respectfully submits that claims 2-12 and 14-20 are all patentable over the cited prior art. Therefore, Applicants respectfully request that claims 2-12 and 14-20 be allowed and the application be passed to issue.


If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 50-0238 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17, particularly extension of time fees.

Respectfully submitted,

VOLENTINE FRANCOS & WHITT, P.L.L.C.

Date: 18 September 2006

By: _____


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APPENDIX - CLAIMS ON APPEAL

2. The mask as claimed in claim 14, wherein the auxiliary pattern is disposed on at least one of a central portion of the first surface and a central portion of the second surface.

3. The mask as claimed in claim 14, wherein the auxiliary pattern is of an optical interference material.

4. The mask as claimed in claim 14, wherein the auxiliary pattern is of an opaque material.

5. The mask as claimed in claim 4, wherein the auxiliary pattern is of chromium.

6. The mask as claimed in claim 14, wherein the auxiliary pattern has a line width of 30 nm to 200 nm.

7. A method of fabricating a phase edge phase shift mask, the method comprising:

providing a transparent substrate;

etching the transparent substrate to form a trench in the substrate, the trench being situated beneath a first surface of the substrate and having a side defined by a sidewall surface of the substrate and a second surface of the substrate defining a bottom surface of the trench;

forming a layer of material on the substrate at the side thereof in which the trench is formed; and

etching the layer of material to form an auxiliary pattern therefrom on at least one of said first and second surfaces of said substrate as spaced laterally along said at least one of the first and second surfaces from said sidewall surface defining the side

of the trench,

wherein when the mask is used to pattern a photoresist layer, a photoresist pattern is formed at an area corresponding to an edge of the trench, and is not formed at areas corresponding to the auxiliary pattern.

8. The method as claimed in claim 7, wherein said forming a layer of material on the substrate comprises forming a layer of an optical interference material on the substrate.

9. The method as claimed in claim 7, wherein said forming a layer of material on the substrate comprises forming a layer of an opaque material on the substrate.

10. The method as claimed in claim 9, wherein the opaque material is chromium.

11. The method as claimed in claim 7, wherein said etching a portion of the material comprises forming an auxiliary pattern having a line width of 30 nm to 200 nm on at least one of said first and second surfaces of said substrate as spaced laterally along said at least one of the first and second surfaces from said sidewall surface defining the side of the trench.

12. The method as claimed in claim 7, wherein the transparent substrate is quartz.

14. A phase edge phase shift mask comprising:

a transparent substrate having a first surface and a trench constituting a 180° phase shift region, a second surface defining a bottom of the trench, and a sidewall surface extending from the first surface to the second surface and defining a side of the trench; and

an auxiliary pattern disposed on at least said second surface,

wherein when the mask is used to pattern a photoresist layer, a photoresist pattern is formed at an area corresponding to an edge of the trench, and is not formed at areas corresponding to the auxiliary pattern.

15. The mask as claimed in claim 14, wherein the transparent substrate is quartz.

16. A phase edge phase shift mask comprising:

a quartz substrate having a first surface and a trench constituting a 180° phase shift region, a second surface defining a bottom of the trench, and a sidewall surface extending from the first surface to the second surface and defining a side of the trench; and

an auxiliary pattern disposed on said first and second surfaces,

wherein when the mask is used to pattern a photoresist layer, a photoresist pattern is formed at an area corresponding to an edge of the trench, and are not formed at areas corresponding to the auxiliary pattern.

17. The mask as claimed in claim 16, wherein the auxiliary pattern is of an optical interference material.

18. The mask as claimed in claim 16, wherein the auxiliary pattern is of an opaque material.

19. The mask as claimed in claim 16, wherein the auxiliary pattern is of chromium.

20. The mask as claimed in claim 16, wherein the auxiliary pattern has a line width of 30 nm to 200 nm.

EVIDENCE APPENDIX

{None}

RELATED PROCEEDINGS APPENDIX

{None}